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OKSCAUG 2018

Mobile Mapping | Mass Data Collection

THE PROBLEM

Traditional methods of data collection can be…

Time-Consuming

Labor-Intensive

Costly

Dangerous

MOBILE MAPPING: THE SOLUTION

What is mobile mapping?

Process of collecting geospatial data from a mobile vehicle or platform.

WHY MOBILE MAPPING

QUALITATIVE ANALYSIS

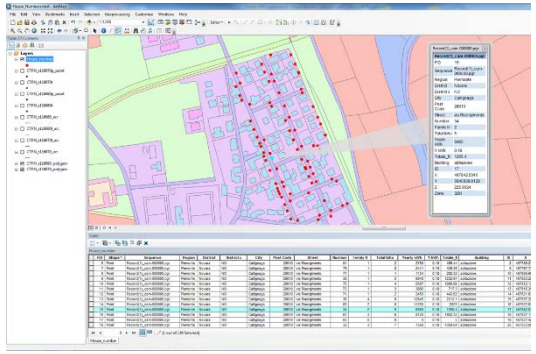
- A picture is worth a thousand words
- Visual inspections on critical buildings and infrastructures

QUANTITATIVE ANALYSIS

- Check object positions
- Measurement directly on images

ADVANCED GIS ANALYSIS

- Geostatistics
- Spatial analysis



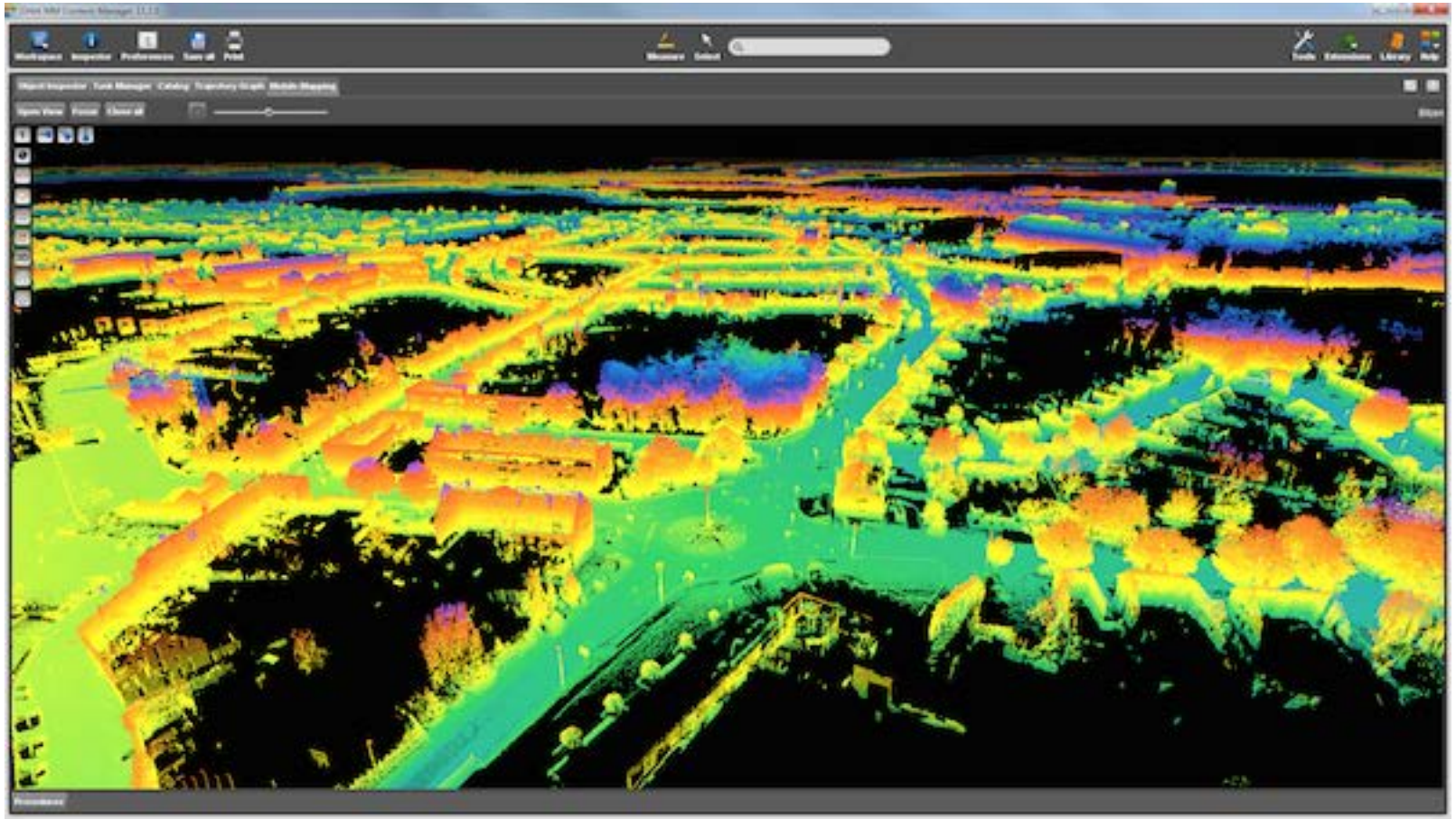
WHY MOBILE MAPPING

BENEFITS OF MOBILE MAPPING WITH IMAGERY

- Easy Asset management
- Quicker GIS collection cycles
- More frequent Inspections
- Safety
- No site returns
- Share data

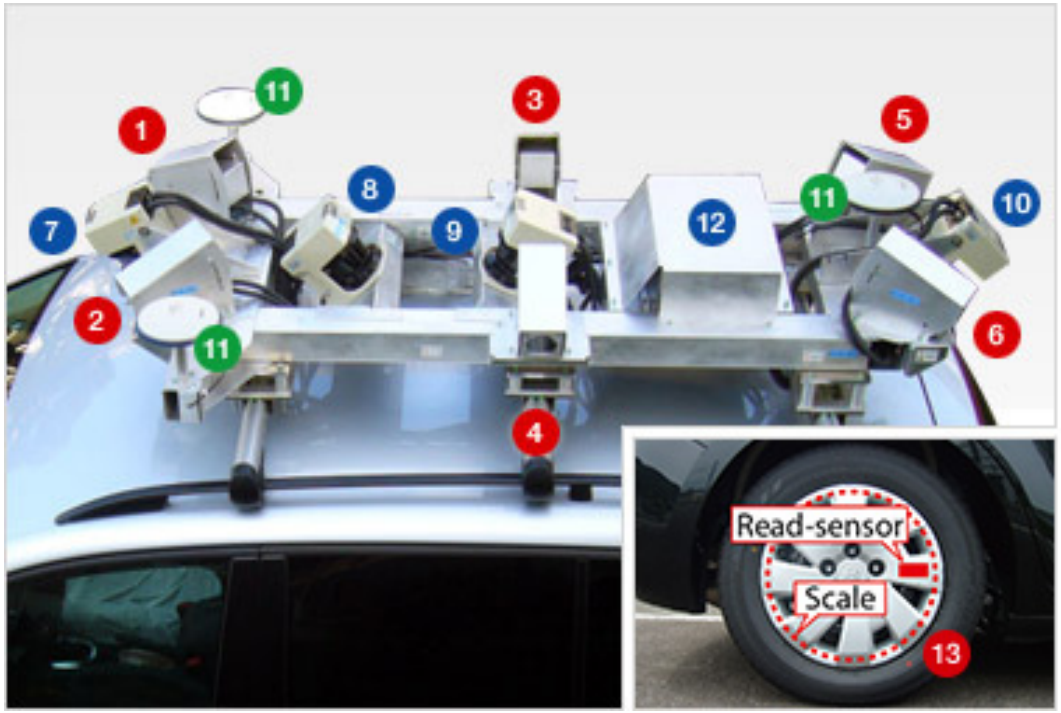
Video

Collect Everything: Use What You Need



Non-Integrated Systems

MANY OPTIONS FOR SENSORS



1 Camera (front; right)
2 Camera (front; left)
3 Camera (side; right)
4 Camera (side; left)
5 Camera (rear; right)
6 Camera (rear; left)
7 Laser scanner (front; downward)
8 Laser scanner (rear; upward)
9 Laser scanner (front; upward)
10 Laser scanner (rear; downward)
11 GPS antenna
12 IMU
13 In-wheel odometer

Trimble MX7 and Trimble LMM portfolio

GIS MAPPING

- GIS deliverables, visual

SURVEY BASICS

- GIS deliverables, visual
- Volumes, contours, survey deliverables

SURVEY

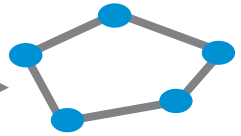
- GIS deliverables, visual
- Volumes, contours, survey deliverables
- Engineering deliverables

ACCURACY

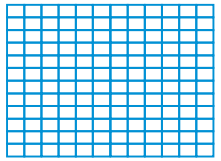
TRIMBLE MX7

GPS RECEIVER/IMU

DIGITAL CAMERA



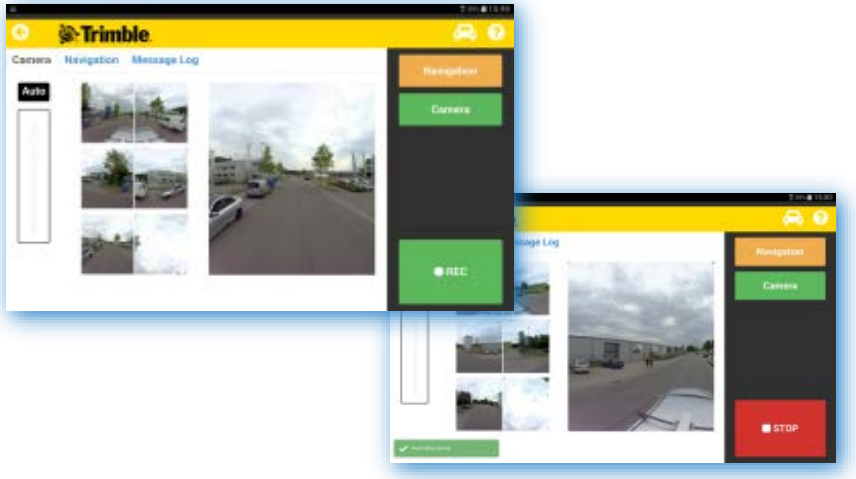
Vector Data



Images

3D Lines & Points

TRIMBLE MX7 | HOW IT WORKS



Collect

Trimble Mobile Imaging Software

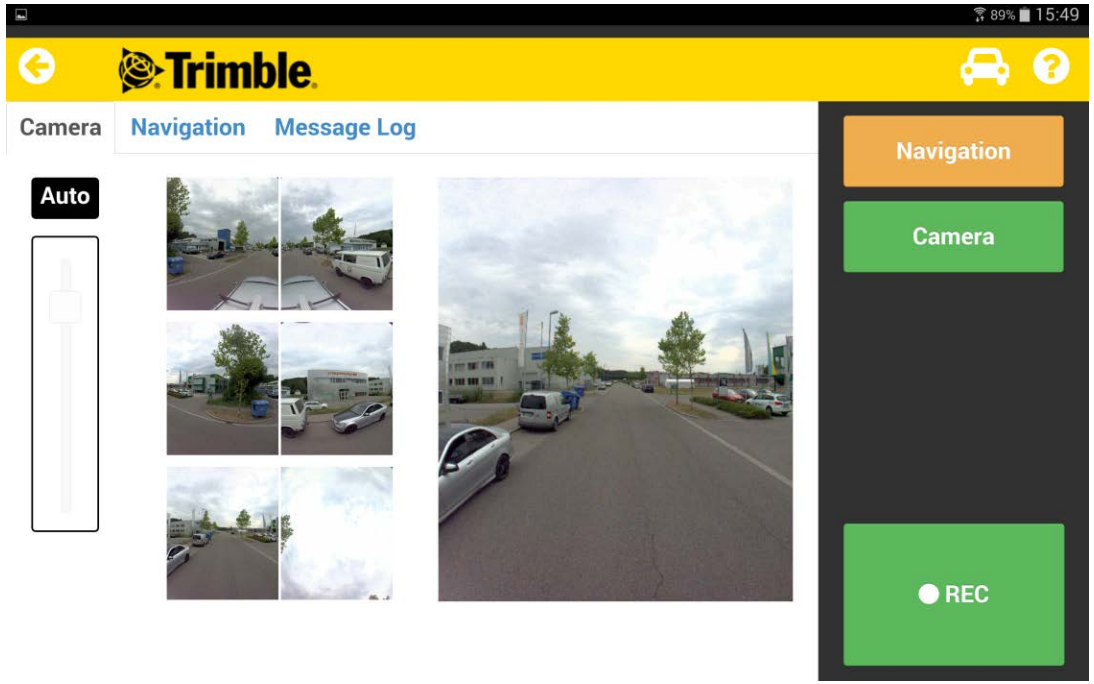
Process

POSPac MMS

Deliver

Trimble MX Software Suite

SIMPLE DATA CAPTURE

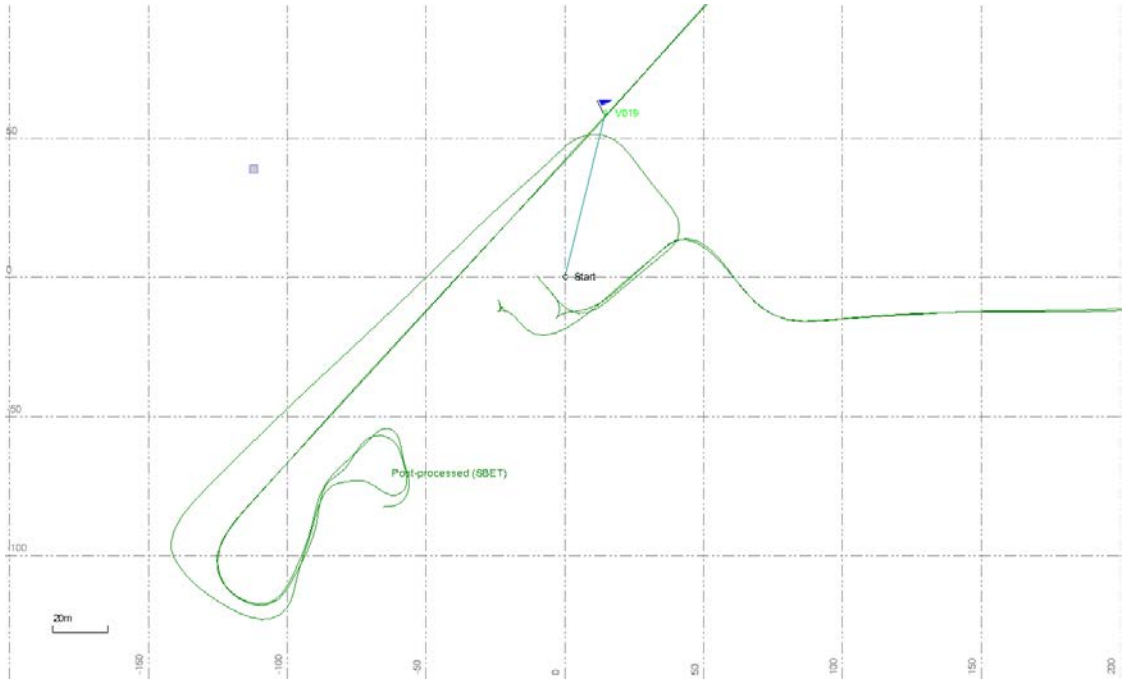


TRAJECTORY POST PROCESSING

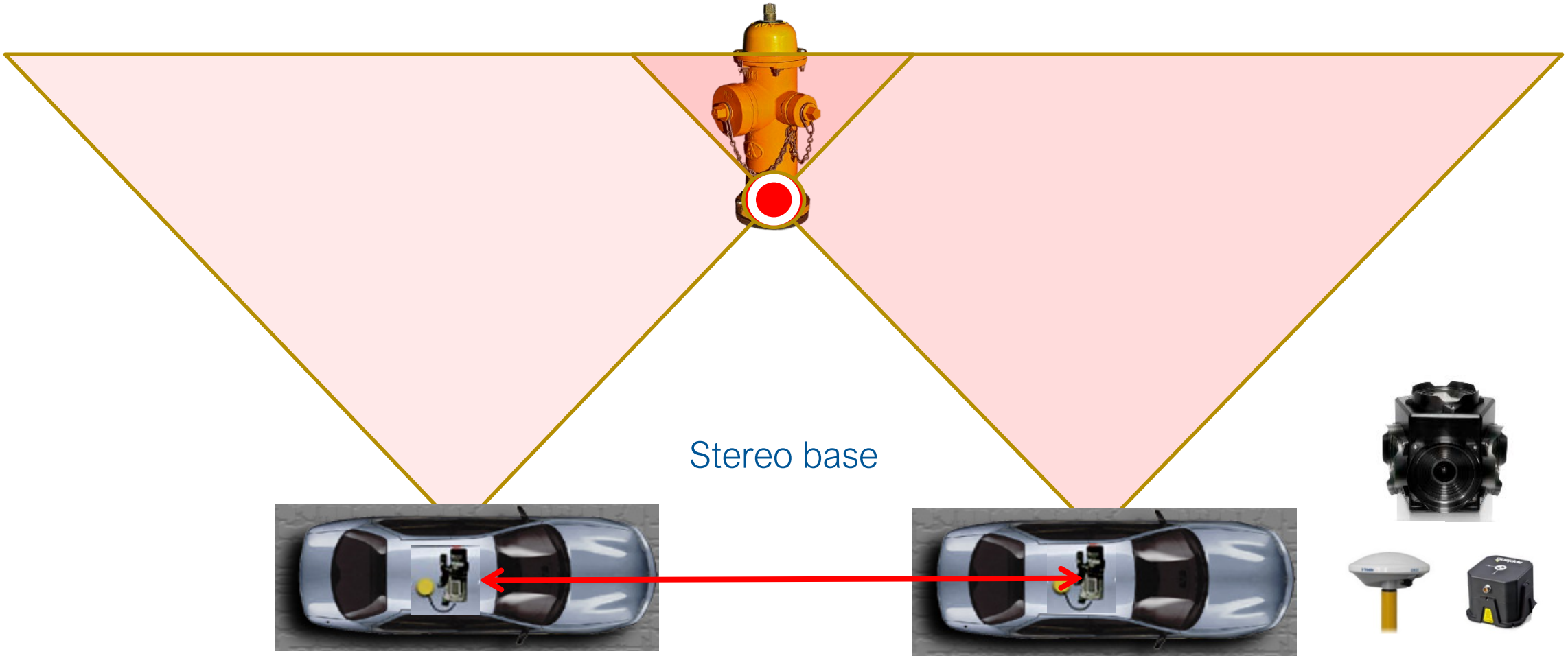
- Inertially aided PPK – tightly coupled solution
- Uses local base station
- Forward-Backward-Precise forward time series processing
- Kalman filtering
- Positioning 2-5cm in good conditions

Real-time result

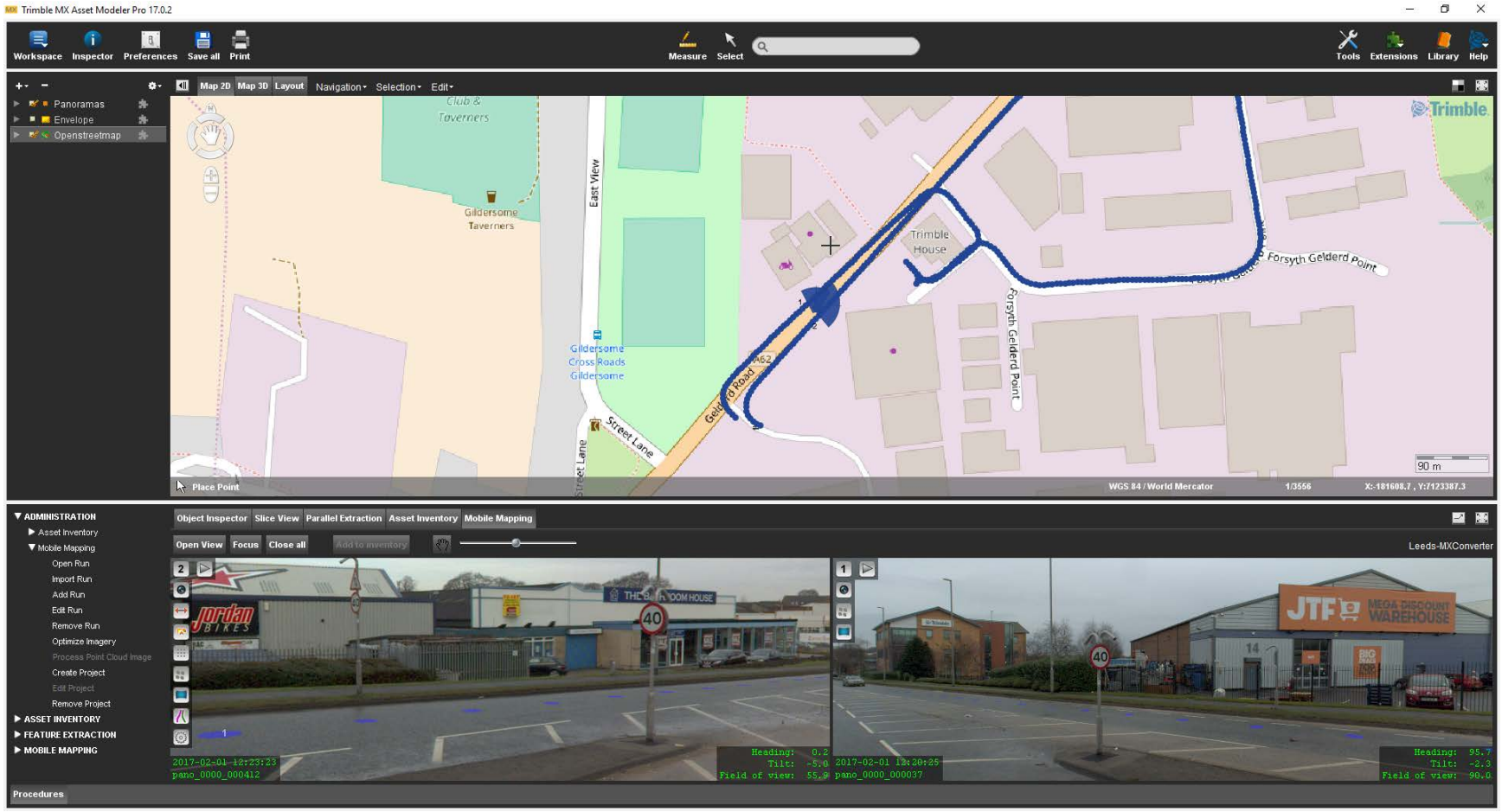
Post-processed result



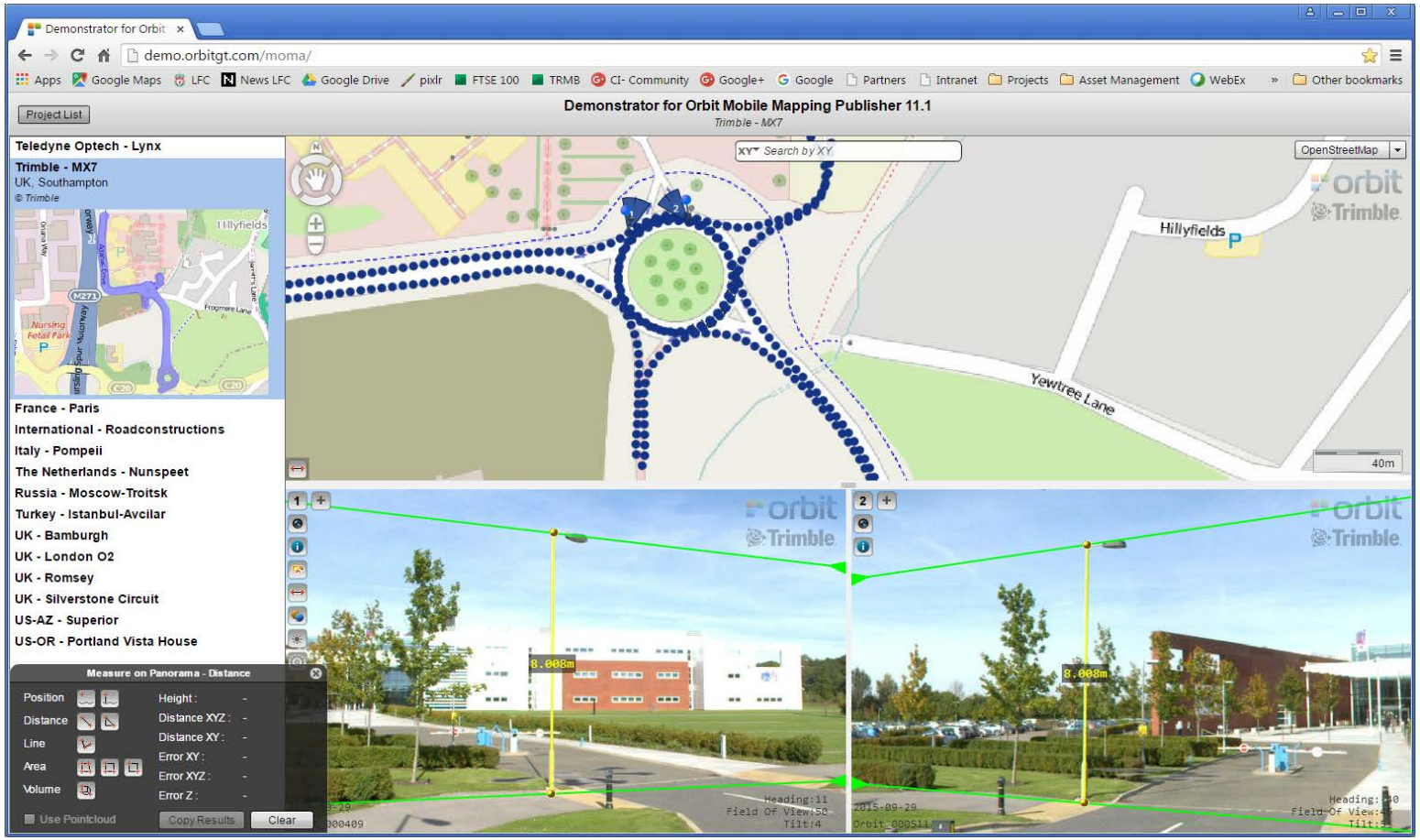
COLLECTING ASSETS THROUGH IMAGES



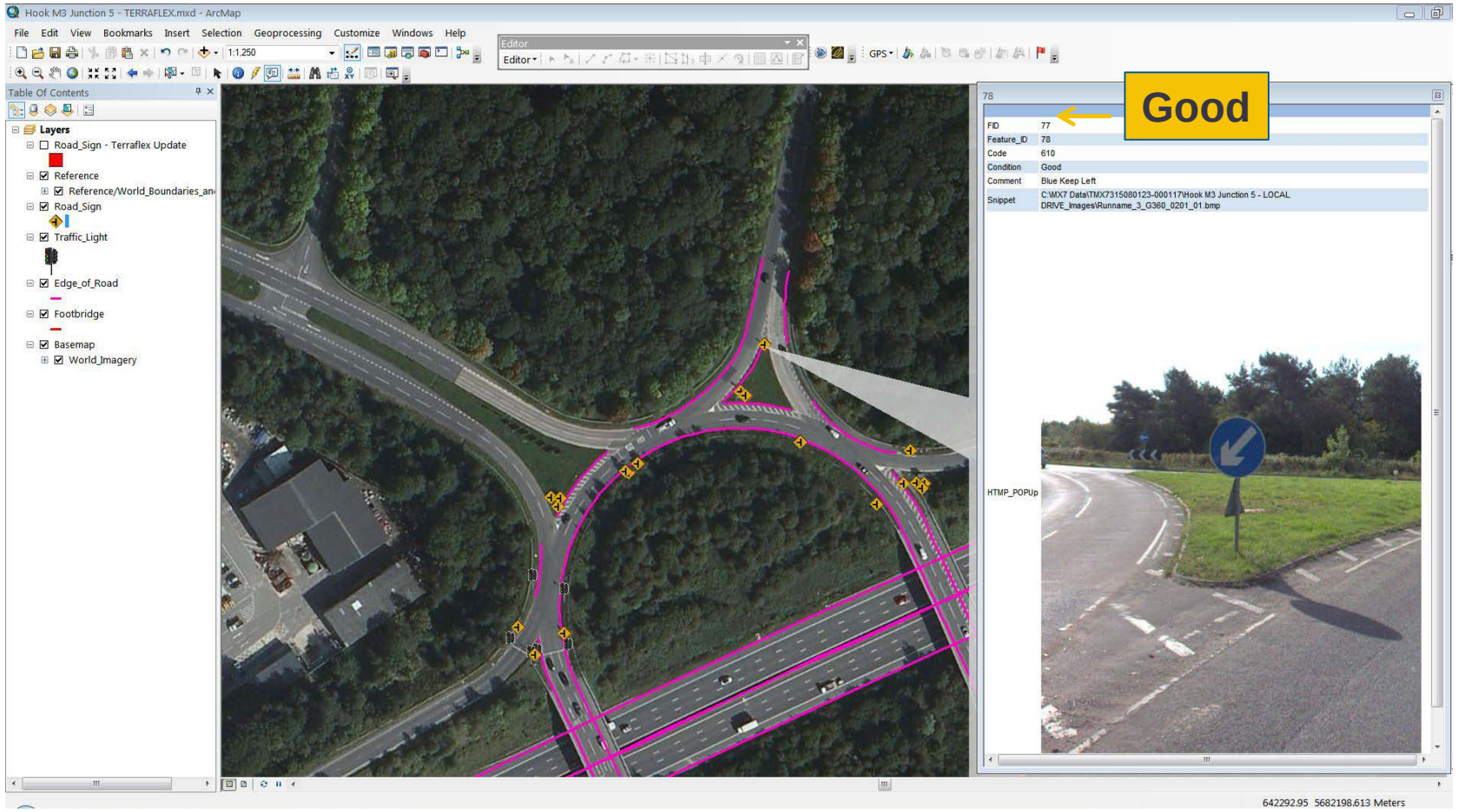
TRIMBLE MX ASSET MODELER



LOCATE, MEASURE, DOCUMENT, SHARE



MX7 DATA IN ArcGIS

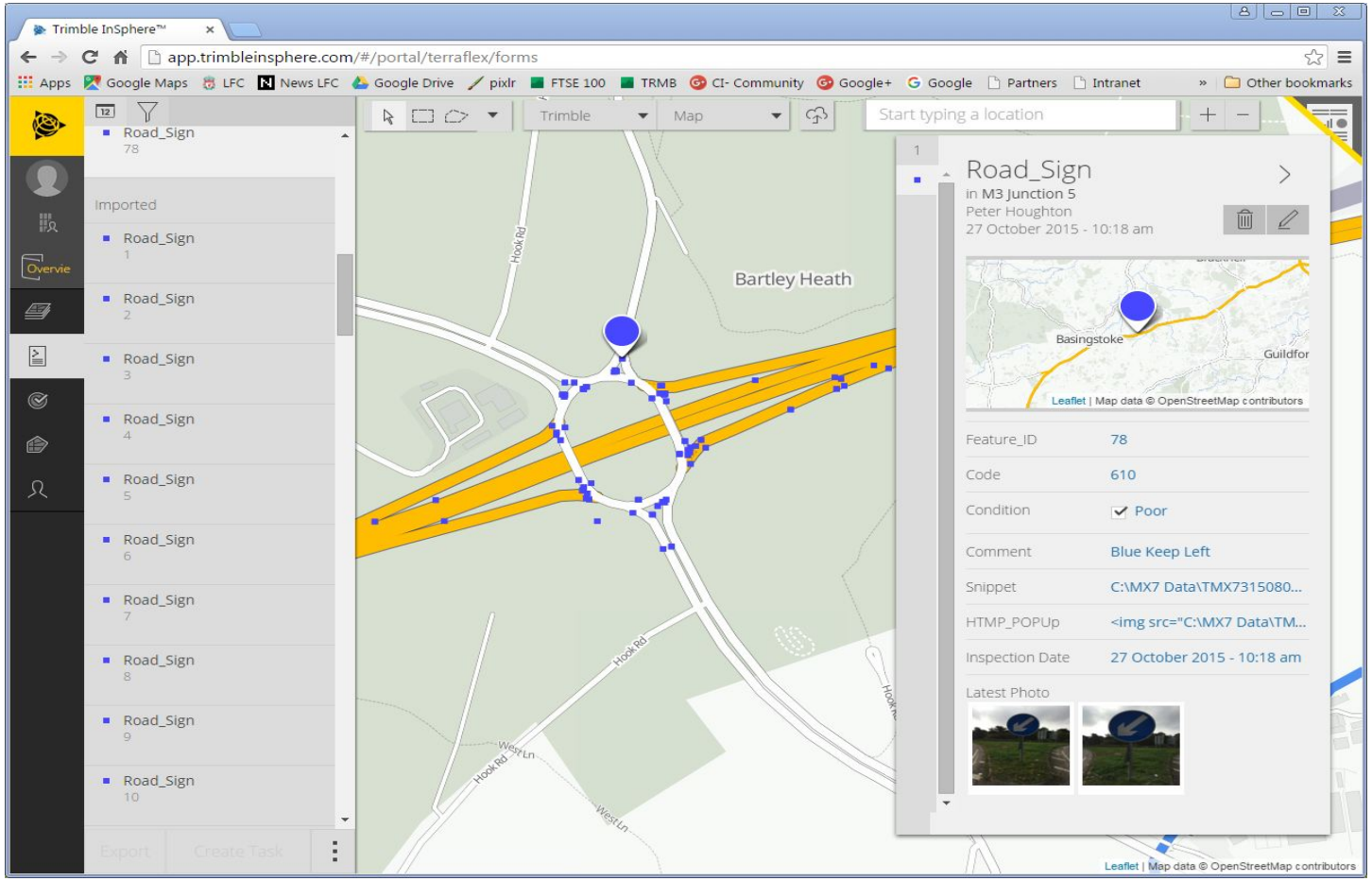


esri

Trimble.

MX9 DATA IN TMX

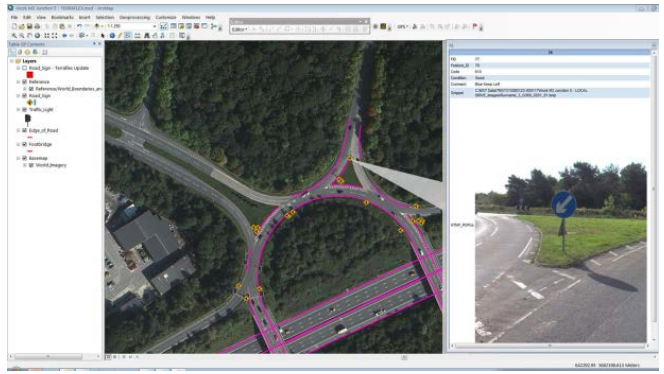
UPDATE ASSET DATA | TRIMBLE TerraFlex



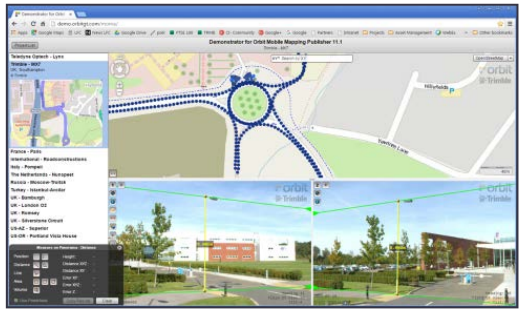
FIELD INSPECTION | TerraFlex

MOBILE MAPPING | CORE FUNCTIONS

1. Visualization
   - View and understand your environment
2. Photogrammetry and Object Identification
   - Locate, Measure and Document: assets, points of interest, structures, vegetation, infrastructure networks, project sites, etc.
3. Detect Changes
   - Identify changes in your environment over time
4. Publish and Share Data
   - Share imagery and information across the organization
5. Improve Decision Making



MX7 Data in ArcGIS



MX7 Data Online

MOBILE MAPPING USES | LOCAL GOVERNMENT

- Mass Data Capture of citywide 3D deliverables
  - Asset inventory
  - Location and inspection
  - Image logging
  - Planning

MOBILE MAPPING USES | RAIL

- Centerline
- Assets
- Offsets to rail
- Inspection
- Rock ballast
- PTC
- Clearances

MOBILE MAPPING USES | OTHER LAND OPPORTUNITIES

- Construction, Mining, and Aggregates
- Emergency Response, Insurance Inspection, and Security
- Structure & Safety Civil Engineering
- Airport Engineering, Design, & Construction
- ISMP: Integrated Storm Water Management - The goal of ISMP is to balance between: land use planning, storm water engineering, flood and erosion protection, and environmental protection

CASE STUDY | HIGHWAY INVENTORY

Scope. . .

- → Pavement marking collection to verify c
- → Extraction of existing passing lanes for
- → Signage collection and verification that
- → +200 intersections of extraction
- → 835 km of data collection in both directi
  - 1670 kms total

- → CAD
  - 2D/3D Linework (dxf)
  - Cross Sections
- → GIS
  - Atributed Point data (csv)
- → 360 Photos
- → 2000 passing lanes extracted
- → 3000+ signs extraced

Leverage Engineers / Drafting expertise to extract information rather then Field Staff.

CASE STUDY | CITY OF AMSTERDAM

In June 2017, the City of Amsterdam released over 800,000 panoramic images as part of City Data, Amsterdam's open data initiative. The images were captured using the Trimble MX7. Within one week of the public release, Mapillary imported the imagery as fully interactive street view, with 97 types of features extracted from the imagery using computer vision.

City wide mapping initiative

New York City intersection 3D model rendering. Flickr, February 16, 2016. https://www.flickr.com/photos/architectural_rendering/24700051069

PIPELINE APPLICATION

- SAIPEM is one of the global leaders in drilling services, as well as in the engineering, procurement, construction and installation of pipelines and complex projects, onshore and offshore, in the oil & gas market
- SAIPEM operates in 68 countries, with more than 40,000 employees, and has been in the pipeline business over 60 years

PIPELINE APPLICATION

- For pipeline applications, SAIPEM has a huge number of projects/ construction sites, part of those mainly subcontracted to 3rd party companies
- For this specific application, SAIPEM needs accurate information about pipeline positions, and mainly of pipeline welding positions
- The welding positioning tasks are mainly covered by employing survey companies. On construction sites, surveyors use GNSS Kit to map pipeline welding

PIPELINE APPLICATION

- Survey activities in this kind of construction site are quite dangerous. Heavy machines moving on site, terrain stability and other components are harming safety of the operators when performing survey duties

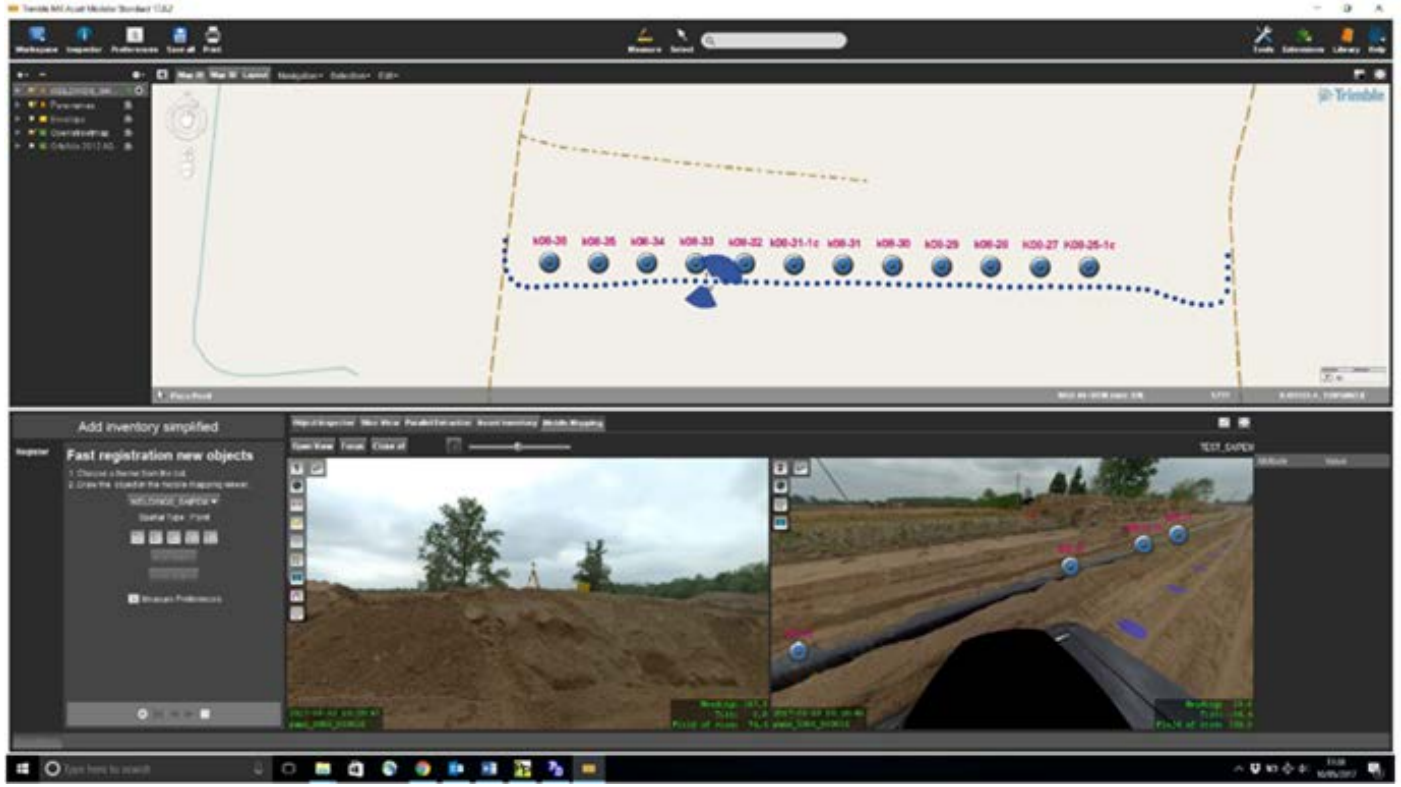
- For the above reason, SAIPEM decided to look for safer and more productive workflows. Land Mobile Mapping was selected as a possible alternative

PIPELINE APPLICATION

- A Trimble MX7 demo was organized on 2 different construction sites scenarios
  - The first test/demo was performed on a pipeline site in Italy, where absolute/relative accuracies had been checked.
  - The second test was performed in KSA to test behavior of Trimble MX7 when operating in high Middle East temperatures
- Both tests/demos gave good results

PIPELINE APPLICATIONS

- MX7 performances



PIPELINE APPLICATIONS

- MX7 performances

Dati LMM Trimble MX7					Dati RTK Rilievo GNSS Classico					Differenze		
Welding	X	Y	Elev_Pipe	Elev_Ground		Y	X	ELE		est	nord	ele
K08-26	497650.858	5016099.564	140.049	141.682	12	5016100	497650.9	140.078	K8-26	-0.025	-0.055	0.029
K08-27	497635.967	5016099.619	140.067	0.000	11	5016100	497636	140.131	K8-27	-0.020	-0.072	0.064
k08-28	497621.074	5016099.740	140.469	0.000	10	5016100	497621.1	140.482	K8-28	-0.029	-0.094	0.013
k08-29	497606.136	5016099.784	140.730	0.000	9	5016100	497606.1	140.721	K8-29	-0.013	-0.033	-0.009
k08-30	497591.200	5016100.018	140.656	0.000	8	5016100	497591.2	140.71	K8-30	-0.004	-0.137	0.054
k08-31	497576.227	5016100.099	140.721	0.000	7	5016100	497576.2	140.703	K8-31	-0.016	-0.073	-0.018
k08-31-1c	497561.403	5016100.270	140.793	0.000	6	5016100	497561.4	140.786	K8-31-1C	-0.003	-0.040	-0.007
k08-32	497546.465	5016100.496	140.895	0.000	5	5016100	497546.5	140.874	-	-0.010	-0.094	-0.021
k08-33	497531.705	5016100.605	140.890	0.000	4	5016101	497531.7	140.889	-	-0.043	-0.041	-0.001
k08-34	497516.827	5016100.705	140.848	0.000	3	5016101	497516.8	140.832	-	-0.013	-0.061	-0.016
k08-35	497502.130	5016100.741	140.794	0.000	2	5016101	497502.2	140.752	K8-34-1C	-0.036	0.042	-0.042
k08-36	497487.322	5016100.894	140.652	0.000	1	5016101	497487.3	140.643	-	-0.021	-0.067	-0.009
										-0.019	-0.060	0.003 Valori Medi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Manta, Manabí Province
Google, Inc.
Street View - Feb 2015
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Calle 105
Calle 106
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QUESTIONS

THANK YOU